The WALLABY multi-wavelength dataset and pilot studies

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The WALLABY survey

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Sensitivity: 1.7 mJy/beam per channel
Coverage: Dec<30°
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$4.4 \times (1+z)^4 \ M_\odot \ \text{pc}^{-2}$ (20 km/s line width)

Area/detections: 30940 deg$^2$ sky, 500,000 galaxies

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- Statistic analysis
- Multi-wavelength
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The WALLABY Session on Tuesday;  
Karen Lee-Waddell’s talk in the afternoon.
Multi-wavelength data: optical

Skymapper: whole sky (Christ Wolf’s talk on Thursday)

[r-band]
Skymapper: 21.7
DES: 24.3
VST-ATLAS: 22.2
KIDS: 25.2
(SDSS: 22.2)

M*, stellar population, structure, morphology, etc.

Taipan: synergetic observation with WALLABY (?)
Other IFU surveys (Luca Cortese’s talk on Tuesday)
Multi-wavelength data: UV&IR

**GALEX:** NUV&FUV
NUV only

- $L_{\text{FUV}}$: un-attenuated SFR
- $L_{\text{FUV}}/L_{\text{NUV}}$: attenuation (diffuse ISM)

**WISE** (w1-4: 3.4, 4.6, 12, 22 μm)

- w1 & w1-w2: $M^*$
- w4: attenuated SFR
- w3-w4: AGN identification
The individually invisible HI

A pilot study about gas accretion and how we make use of the vast blank regions in HI data cubes
The technique

An application of the ASKAP source finder software SoFiA (Serra+15):

Wang+15
HI conformity

Consistent with the cold-mode accretion predicted by theory
In the era of WALLABY

- Is it really cold-mode accretion: better statistics, measuring spatial orientation
- IGM of groups/clusters (WALLABY ES)
  
  (Serra+2016: 10% of the gas is outside galaxies)
  
- Combining WALLABY with DINGO: do we already know the HI mass function with relatively shallow imaging data
What makes the very similar HI disks?

A pilot study about how complicated physics results in simple scaling relations of galaxies
The remarkable HI size-mass relation

Wang+16
Scatter of the relation

No change of scatter across the wide range of properties. A strong constraint on galaxy formation models.
In the era of WALLABY

- A homogeneous dataset and complete census of galaxies
- Combining kinematic properties and mass distribution from tilted-ring fitting

(Kamphuis+15: galaxies with diameters > 8 beams across are suitable for 3D tilted-ring fitting)

- Predicting the HI disk size for un-resolved WALLABY galaxies

~1000 galaxies suitable for 3D tilted ring fitting
Summary

We will have a booming of multi-wavelength data for the southern sky. We will be able to gain insights into several aspects of galaxy formation and evolution, including:

- Galaxies growing in large-scale structures with the large-scale gas reservoir
- Galaxies growing in a well regulated way, with the different processes well balancing each other.
Clues from the radial distribution of HI

- The early type disk galaxies may have a different gas assemble history.
- The late-type and dwarf galaxies may share a common mechanism in setting the HI surface density.